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JUN 28 '84

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The Challenge of Technological Change in Canada

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"The technological revolution, by increasing our control over matter, time and space, shapes the evolution of our economics, lifestyles, thought patterns and systems of reference. It will have a positive or dangerous effect on unemployment, inflation and growth, according to the way in which it is managed. Without further delay, and in the interests of democracy and peace, we must draw on the immense resources of knowledge."

Francois Mitterrand
President of France
Versailles, June 1982

Technological innovations are irrevocably changing the world in which we live. Not a day goes by when we are not bombarded by the term "high-tech"; we read about it, hear about it, and watch it on television. The most recent development which caught my eye were high-tech socks which defy gravity, surely an invention which signifies the degree to which we have stepped in to a new era!

In this paper, I will focus on what technological changes mean to Canadians in general, and to Albertans in particular. I will offer a broad overview of the shape and scope of technology in the Canadian market. The question I address is: Where is Canada's economy going in a changing world economy? It is a question which is often posed these days, and one which the Royal Commission on the Economic Union and Development Prospects for Canada also confronts. It is my objective to present the issues and questions which surround the development of science and technology in Canada.

Reading through the massive number of reports on the possible effects of technological change on a society, two different responses are identifiable which effectively represent the scope of the debate. First, there are those who fear technological change. Then there are those who fear the lack of it. Technological change is viewed either

as Pandora's Box or Prometheus' gift to mankind. Technology has the capacity to save us or to destroy us, to help us create or destroy. Participants in the competition to win the technology race are lured by the great potential and leary of the great vulnerability.

Before proceeding to delve any further into the subject, "technology" must be defined. Business Quarterly defines high-tech as the "practical application of newly discovered scientific knowledge to solve society's problems, particulary in the context of microelectronics, computers, and communications."[1] In a document, Towards 1990 : Technology Development for Canada, published by the Ministry of State for Science and Technology in Canada, it is emphasized that "technology policy cannot be separated from social policy as it also has an impact on employment, health, environment, lifestyle and other social issues." [2] Social and economic policies must be adjusted to meet the changes which technological developments bring into our lives.

It is important to note that not all technology is created equal. In his article, "Advice from Japan," Akira Kubota distinguishes three types of technology: high technology, medium technology, and low technology.[3] High-tech industries are those space-age technologies which are seducing nations. High-tech corporations demand a strong highly skilled labor force and a large capital base. Major new technologies are found in: the energy sector; electronic developments; biotechnology; solar biomass; and transportation. Middle technology industry includes the heavy manufacturing "or smoke stack industry--the industries which produce automobiles, and automobilt parts, TV sets, railroad cars, steel ships, machine-tools and electrical appliances." [4] Low technologies include such labor as the manufacturing of souvenirs, the textile industry,

Technological capability has always been covetted. The Greek gods severely punished Prometheus for giving mankind the gift of fire. Technological superiority is a fickle position. It was only one hundred

years ago that Europe dominated the technology race. In 1973, Jacob Bronowski observed:

> We are a scientific civilization . . . The ascent of man will go on. But do not assume that it will go on carried by western civilization, as we know it . . . The next step will be taken -- but not by us. 5

Which nations, then, are leading the race towards technological supremacy? Japan is recognized as the "nation most likely to succeed." Japan has a very comprehensive strategy to become dai-chi (number one) , and I will examine the elements of her plan further in this paper. The United States is at the forefront of the race, although Japan is giving the United States some difficult competition. South Korea and Taiwan are two of the members of the newly dynamic east-Asia nations which are displaying advanced technological performance. France and West Germany are among the other nations at the forefront of technological superiority.

The world economy in which we must now compete is totally unfamiliar. Technological innovations are evolved at an extremely rapid rate. We now must perform within a global economy. Old institutions are changing, economies are being redefined, social upheaval is not unfamiliar, markets are distrupted. It is indeed quite a storm to be weathered. Alvin Toffler describes the changes we are experiencing in the transition to becoming an information as the "third wave." Toffler describes daily life as having a harassed knife edge quality. He states, "There is a sick odor in the air. It is the smell of a dying Second Wave [the Industrial Revolution] civilization." 6 In the new global economy, the stakes are high and the competition is fierce.

How, then, does Canada rate in this new environment? Poorly. Technological issues have not been high on the political agenda in the last decade. Indeed, Canada's dominant class, the financiers, the bankers, the traders, have neglected the need for change. It is only in the last two or three years that technology has captured their attention. Almost

too late, Canada's leaders have recongized that the survival of the nation depends upon adapting to the changing global economy.

In our short history as a nation, Canadians have been characterized as hewers of wood. With our abundant natural resources, we have been fortunate enough to prosper. As research and development offer cheap and efficient alternatives to our oil, natural gas, coal, and other resources, Canada will face a crisis if we do not have some share of the technological market.

In its submission to the MacDonald Commission, the Science Council of Canada emphasizes that

> Canada must diversify into the new expanding knowledge-intensive industries as a prudent and overdue measure to protect our economic future and our political survival. 7

While our western trading partners have vigorously pursued industrial strategies, Canada's "trade deficits in technology intensive manufactured products. . . has been widening." [8] M. E. Smith argues that the problem of weak industrial technological growth lies not with government but with the industrial sentor in the following paragraph:

> . . . the problem is not necessarily that the Canadian government's R & D performance is inordinately strong, but that the industrial sector's R & D efforts are inordinately weak. 9

In 1979, Canada placed "seventh in the world (behind the U.S.A., Japan, West Germany, France, the United Kingdom, and Italy) in its expenditure (i.e. $U.S. 2.5 billion) on research and development." [10] Further,

> in 1979 Canada ranked eleventh (at 1.1%) in the proportion of its gross domestic product spent on research and development (behind U.S.A., Switzerland, West Germany, Japan, the United Kingdom, the Netherlands, Sweden, France, Belgium and Norway). 11

When confronted with these statistics, the need for an industrial strategy becomes apparent. Research and development has emerged as a Canadian priority, overriding national unity and traditional social welfare issues.

The focus now is upon the economic gains which may be fostered by science and technology, and on the policy needed to encourage scientific research and development. Until recently, industry has been ignorant of the need for technological development to the point that industry did not even implement existing technology. This neglect has resulted in industries now faced with obsolete production lines. Slowly, the neglect is being remedied. The public is also putting pressure on government over the need for an industrial strategy. Canadians hold a rather schizophrenic view of the coming changes. On the one hand, technological changes are seen as the savior of our national economy. On the other hand, this optimistic attitude conflicts with a profound fear of the transition from an old to a new economy. People are fearful that they will be left jobless, skill-less remnants of another era. Hence, the public want a coherent strategy which defines their roles and their relationship to the new economic order.

For example, one concern being expressed in Canada is whether our universities are graduating students with obsolete skills. Harvey Tenenbaum states that "the anticipated shortage of master and doctoral graduates in science, engineering and management will . . . have an adverse effect on technological development."[12] Tenenbaum observes:

> On a per capita basis, Japan graduates 2.1 times the number of U.S. graduates in these areas, and probably 2.5 times the number of Canadian graduates.[13]

Simply stated, Canada's universities are not producing graduates who possess the necessary manpower requirements and this is a crippling disability to Canada's quest to be internationally competitive. But the issues surrounding educating Canadians is just one example of the discussion which has emerged in our country as to whether Canada has what it takes to enter the technological market.

Briefly, then, Canada's performance in the technological arena

is poor. How has Japan faired so well, then?

There are nearly 400,000 R & D workers in Japan. The Japanese goal is to triple its R & D budget (15% of its GNP in 1980) by 1985. [14] Central to its strategy is the Japanese willingness to follow the powerful guidance of its government through the Ministry of International Trade and Industry (MITI). Japan's economic policy is founded upon a high perception at home and abroad, of mutual necessity. In Japan, there exists a consensual cultural value . . . that of common survival. All parties in Japan, including business and government, copperate in fighting a trade war. They have "a strong commitment to re-design, re-engineer, upgrade the production process." [15] Foreign investment is confined to limited areas, and only on a strictly limited basis. International trade involves a high degree of human and cultural contact, through business exchanges, for example. Japan seeks varied sources of raw material, and deals for long-term contracts to ensure stable supplies. Briefly, these are the key elements of Japan's economic strategy.

Roy Matthews in his article, "Canada in a Changed Economy," advises that

> More important than specific plans . . . is a broad agreement among the people of these societies as to what goals they are aiming to achieve communally and how those goals translate into the everyday life of each individual. 16

How can we describe Canada's commitment to an industrial strategy?

Canada's local social and political conditions are confusing abroad . . . they confound even Canadians. Canada is best described as a collection " of mutually hostile tribes within the bosom of a single state." [17] Perhaps the greatest obstacle to Canada's success in the international market, is that we have too fragmented a nation to pursue collectively a national industrial policy. It is foreign to our national nature to act cooperatively. We are a nation divided along

regional, cultural, linguistic, occupational and social lines, yet bound together in a single state. Canada does not possess an overview, as Japan does, of the need to work cooperatively in the pursuit of an industrial policy. Despite the facts that we cannot escape the need for change, that we must involve ourselves in the transition to a technological society, that business, government and labor must cooperate to encourage technological innovation in Canada, we are late to see the need to order ourselves into a united country with a common goal. The need for cooperative effort between our federal and provincial governments is evident, but it is also clear the our governments are more likely to quarrel than to cooperate. Our greatest challenge is to establish an agreement on industrial policy in the intergovernmental arena.

Even Canadian industrial groups are very diversified with little in common. Policies which support manufacturing and similar endeavors receive uncertain commitment, namely due to the fact that Canada's economic history is one which has placed great emphasis on the export of raw materials and on our agricultural products. We remain, to a great degree, a staples economy. The debate on issues concerning technology policy is in its infancy, while resource policy and transportation issues continue to dominate the political agenda.

Since Confederaion, different patterns of economic development and interests have evolved ; provincial governments have been the focus of those interests. As the Science Council report on The Challenge of Diversity states, "This has turned the issue of industrial strategy into one of territorial-political conflict." [18] An article in the Edmonton Sun reported that Canada can only get involved in the technological leadership race in a peripheral way, by combining all of Canada's resources into a "formidable pool of talent and skill." [19]

This would demand an unprecedented degree of cooperation in Canada.

Understanding some of the constraints on Canada's commitment to an industrial policy, we can ask more generally, what should be the role of government in leading Canada into the new era of a global economy which prizes scientific innovation. This question almost inspires more debate that the issue of technological change itself. Questions of jurisdiction, as to which level of government -- federal or provincial -- should take the leading role in encouraging technological change is also a matter of crucial importance in Canadian political life. And of course, there is no precedence to guide the debate, so it is quite a race for dominance which we are witnessing in Canada now.

Powerful guidance by the government is central to Japan's industrial strategy. European nations also have created political structures which are crucial to their nations' industrial development. Policy objectives between government, business, and labor are communicated effectively. While other nations are actively pursuing technological supremacy with a spirit of cooperation between different sectors, Canada's response to the problem is to form a Royal Commission to ask if

> . . . ongoing economic cooperation be furthered by involving the representatives of labor and business, as well as provincial and federal governments, in a continuing organization that would consider economic policy questions, share information, and develop consensus on economic issues. 20

The answer to this question is obvious to students of political science! We must enter a global economy which involves constantly crossing international borders, yet we are still stumbling across regional and provincial boundaries. While other nations are involved in transnational enterprises, we are still quibbling over transferring products within our domestic markets.

Consensus in Canada as to the appropriate relationship between government, business, and labor is non-existent. The Science Council of Canada argues that

> Ultimately . . . what is essential for the effective implementation of industrial policy is that the central government have the authority and capacity to influence companies and industries. The ability of the state to do this is primarily a function of its historical role in nation building. It is also the result of it being forced, for reasons of industrial collapse or crises, to become deeply involved in the workings of industry. 21

The National Research council contends that

> . . . the federal government should stimulate and incite industry, labor and other components of society to get together, not necessarily all at once or in one place, to organize what will emerge as a consensus of what is really needed to provide an industrial strategy. 22

The Business Council on National Issues, however, does not "believe that a comprehensive national industrial strategy is either feasible or necessary." [23] The reasons offerred to support the Business Council's contention are that it is unrealistic to expect eleven governments which typically pursue divergent policies to agree on a coordinated industrial strategy and that no clear consensus of what such a strategy would entail could be achieved, given Canada's decentralized economic and industrial policy-making powers. The most interesting description, I think, of the problem is presented by Agnus Bruneau, President of Bruneau Resource Management in Halifax:

> I suspect that if we set about to prepare a national industrial strategy that had the agreement of all the parties that are suggested -- that is, provincial politicians, industrial leaders, bankers, labor and so on -- it would look a bit like the Income Tax Act, and not even the experts would know what it really means. 24

Studies in Canadian federalism support the observation that the views expressed in the quotations above stem from the fact that the regions

of our nation feel that existing and past constitutional arrangements and economic forces have prevented regions and provinces from reaching their potential; the feeling that some regions are exploited for the benefit of other parts of the country, namely, central Canada. Understanding the complex nature of our nation enables one to recognize why the formation of a national industrial policy is indeed, a very great challenge.

Stuart L. Smith summarizes succinctly Canada's situation in the following passage:

> Our banks and our investors are not used to these types of risky and fast changing industries; our universities do not educate entrepreneurial graduates oriented toward international marketing; our industries do not enjoy close relationships with our universites (although this is changing a bit lately); our management-labor relations have lacked the team approach required in intensive international competition; and our governments have been much better at fighting with one another over distribution than they have been at demonstrating economic and industrial policy leadership and cooperation. 25

The reality of the new era is that to survive economically there is a need to change quickly in response to international market demands. The economic order demands a degree of flexibility which is unprecedented.

It appears that to meet the demands of the future, the rules in Canada must change. We have institutionalized some habits which are barriers to Canada's economic success. As stated in a C.D. Howe report, "governments must develop a conscious strategy for promoting adjustment." [26] There is a pressing need to carefully examine whether existing public organizations are designed to meet the needs of Canada's changing social, political, and economic order. For example, are crown corporations and government bureaucracy flexible enough for this fast-paced world? Business Quarterly cited five areas which need to be changed: 1) the market itself; 2) technology; 3) human resources;

4) the strategic planning process; and 5) the public policy environment.[27]

It is my belief that some government intervention is necessary in the creation of a science community in Canada and to encourage investment in technology. For example, workers will need assistance to acquire new skills or to relocate. A cushion policy, for the short-term at least, must be designed to ease the process of adaptation. Market failures will have to be monitored and adjusted if necessary. An industrial policy must not only focus on the acquisition of revenues and the penetration of new markets. It must be far-reaching enough to examine the social consequences of the proposed economic strategy, and to act accordingly.

Irving Brecher asks a few questions which must be addressed by our policy-makers:

> When Canada becomes internationally competitive
> can the interventionist strategy be withdrawn?
> Who will determine when we reach that stage?
> And will the beneficiaries of government involvement
> allow it to disappear? 28

Daniel L. Horigan, President of the Canadian Organization of Small Business, fears that we might, in pursuing mechanisms to bring about technological superiority, create "organizational leviathans" which have the potential to dispose of men's liberties.[29] Linda King Taylor cautions that

> Emphasis on [material] growth alone can --
> and does -- create an alienated society --
> [which] depicts itself in . . . suicide,
> divorce . . . 30

Diversification is central to Canada's survival as a nation. But there is a need to ensure that in meeting the objective of economic development that the costs of such development are not excessive, not only in terms of the financial burden, but also in regard to the human and social costs.

What, then, are the actions of our federal and provincial governments taking to make Canada internationally competitive? Until the last year

the federal government has not dared to present a comprehensive industrial strategy, relying instead on an ad hoc approach. The federal government has begun to increase its support of scientific research and development. Favorable tax policies and other forms of tax incentives have been initiated. The government has cautiously identified areas of economic significance. But it is not the federal government that is boldly pursuing industrial policies; rather, some of the provinicial governments are aggressively promoting their own industrial strategies.

Time restrictions preclude an indepth of analysis of either the federal or provincial governments' strategies. However, I will briefly outline the objectives of the provinces most involved in encouraging technological development. While the federal government has moved cautiously and slowing, consulting and re-organizing before aggressively pursuing an industrial strategy, there are a number of provinces which have been actively promoting their own industrial development programs.

British Columbia, Saskatchewan, and most recently Alberta, have issued powerful policy statements and have begun laying the foundations of their strategies. Their strategies are focussed upon "developing and upgrading the processing of their natural resources and on capturing certain high technology areas (eg. microprocessors, health care goods and services)." [31]

In 1978, the British Columbia government issued a position paper, titled An Industrial Strategy for Canada, which supports a free trade policy and minimum government intervention. It established a ministry to sponsor high-tech, created a Science Council, and funds a Discovery Parks Foundation .

Saskatchewan's N.D.P. government was more activist than the norm. Its development policy focusses on encouraging manufacturing and resource processing. Back in 1976, its Department of Industry and Commerce

presented a policy document called "An Industrial Development Strategy for Saskatchewan," which outlined the government's priorities. The strategy relied on public enterprise for developing major resources, and the government entered joint ventures with the private sector in resource processing. The Saskatchewan Economic Development Corporation (SEDCO) plays an important role as a money lender to small local entrepreneurs. The government encouraged high-tech through the creation of a research park at the University of Saskatchewan. A provincial research council has a technology transfer role. The government also uses Crown corporations to create new high-tech industries, such as Saskatchewan Telecommunications. The new Progressive Conservative government has favored less government intervention, with greater emphasis on private sector initiatives. Broadly based diversification is not the plan; rather, Saskatchewan is concentrating on applying high-tech to its resource base.

The Ontario government is encouraging high-tech innovation. It established the Employment Development Fund (EDF) to offer investment incentives to industry; for example, a $28 million grant was given to the Ford Motor Company to build an engine plan in Windsor. In 1980, a new cabinet Board of Industrial Leadership and Development (BILD) superseded EDF; it is responsible for coordinating government spending on industrial, resource, transportation, and regional development, human resources and community infrastructure. It also acts as a link with other federal and provincial government agencies. Ontario is focussing attention on the following areas: 1) nuclear generation; 2) rail and transit electrification; 3) transportation; 4) natural resources; and 5) mining machinery. Ontario's Innovation Development for Employment Advancement Corporation (IDEA Corporation) assists technology intensive industry by funding R & D projects, managing joint ventures. IDEA has

been used to establish technology development centres in microelectronics, resource machinery, auto parts, CAD/CAM, robotics, and farm equipment. Ontario plans to improve on-the-job training programs, offer more job employment counselling, and provide institutions to expound high-skill training.

Quebec's industrial strategy is very comprehensive. It impresses me because it also offers an official examination of the problems and prospects of its diversification strategy. Like the other provinces, Quebec is developing its resource base, with great attention in increasing its hydroelectric capacity. The government offers its assistance to small and medium sided industry in an attempt to stimulate the development of smaller indigenous businesses. The CDP, the Caisse, is one of the largest sources of capital in Quebec, and it is inovlved in industrial restructuring. Crown corporations play important roles in the province. The Societé générale de financement (SGF) is an investment and holding corporation. The Société de développement industriel (SDI) offers industry development loans and grants. Research and development is actively promoted in Quebec. Like the other provinces, Quebec has a provincial research council, the Centre de recherche industrielle du Québec (CRIQ). Quebec also has a mineral research center. Hydro-Québec houses an electrical technology research centre, the Institute de recherche d'Hydro-Québec (IREQ), which is world-class. The Ministry of Education has an office for science and technology. In its 1982 policy paper, Le Virage Technologique, Quebec laid down its proposals for high-tech. It emphasized three issues: 1) the development of new industrial opportunities; 2) the adjustment of problems facing manufacturing; 3) natural resources development. The government established the Office of Major Projects to implement its three objectives: 1) to encourage industrial spinoffs from megaprojects; 2) to offer financial and technical aid to high-tech service industries; and 3) to create special

assistance programs for electronics and biotechnology. Quebec's strategy merits greater attention. The government's strategy is well-developed and it is designed to complement rather than compete with other provincial strategies. Perhaps the reason why Quebec's strategy is so broad and innovative is because there is special impetus derived from the province's political aspirations.

The other Canadian provinces, except Alberta which I will examine shortly, have pursued technology with less vigour. Manitoba is growing much less rapidly that the provinces briefly described above, relying on secondary manufacturing. Nova Scotia has the most diversified economic base of the Maritime provinces. The strategies of the provinces which I have examined seem to be compatible, at least in their intent. The one problem which might contribute to the further balkanization of Canada's regions is that the provincial economies are becoming more insular. The tendency to turn to provincial rather than national solutions is indicative that the provinces may be drifting apart in terms of economic interest.

What sort of economic strategy is Alberta planning to pursue? In 1974, Premier Lougheed expressed Alberta's central concern that the province was heavily dependent on its natural resources which would be depleted in the medium term. He stated:

> Since entering public life over nine years ago, my theme has been that this province's economy is too vulnerable, it is too dependent on the sale of depleting resources, particularly oil and gas for its continued prosperity . . . Frankly, I despair of the short-term thinking of a few Albertans who believe we can coast on the sale of our depleting resources for our continued prosperity. 32

The Premier of Alberta stated in 1972: "We have a decade to make this transition. I think it should have been started pretty vigourously 10 years ago, but I still think we have a decade to do it." In 1975,

Lougheed said: "The number of sound opportunities for diversification are few. Some which exist today may not exist a decade from today and may be lost forever." Economic diversification has, at the very least, been on the mind of Alberta's Premier. However, the Premier is described in the October 7, 1983 edition of the Calgary Herald as having "rather slyly indicated that it may be necessary to look to agriculture and energy -- rather than economic diversity -- as a means of escaping the current recession." The Premier later attempted to clarify Alberta's position: "Lougheed said . . . critics who accuse him of downplaying diversification have 'misunderstood the play it had in the first place' in his 1974 speech on industrial strategy. Diversification was never intended to eliminate dependency on oil but to reduce it." [33] In the interim, the Alberta government has published a discussion paper entitled, Science and Technology Development in Alberta, in March 1984. Alberta's commitment to an industrial strategy is very unclear, to say the least.

Larry Pratt has stated that Alberta's economic development strategy "is based on the premise that the province has full ownership and control over its resource base." [34] Pratt argues that Alberta pursues a strategy of "province-building" which approaches "nation-building."

The overall objective is the economic well-being of Alberta. The province's strategy of economic development in the last decade has been aimed at achieving balanced regional growth. In the early 1970s, balanced regular growth was part of the Progressive Conservative platform. Alberta's peak period of growth was 1975-1976. To diversify the economic base in Alberta, the government created ten economic development regional offices staffed with government workers there to help local businesses help themselves. Although we might take such community growth for granted,

the change was plotted, and to a large degree, successful.

The government has encouraged small business development. It has sought: resource development; the diversification of Alberta's industrial base; resource upgrading; the development of Alberta as a financial centre; and the development of technological expertise and facilities. It has been the Department of Economic Development's mandate to realize the government's objectives. Alberta has also recognized the need to increase secondary manufacturing and improve our transportation system.

Alberta has been particularly successful in establishing international contacts. One senior official in the Department of Economic Development who I interviewed while researching my Master's thesis, offerred me the following observation:

> The government saw itself facing a window to the world thanks to the energy situation in the 1970s. It recognized then that for a finite period of time, a lot of opportunities, not just in straight financial terms, but it also gave us momentum . . . a place on the 'international stage.' We have used that window to build a permanent kind of economic base in the province which will bring us into the big leagues in financial and economic terms. And that development is related to the resource industry, but hopefully, it will become something removed from the conventional oil industry. 35

Despite its grand ideas, the Alberta government has had to focus its attention on fire-fighting all the problems which face a province which experienced the highs of a boom period and fell to the depths of a severe recession. The economic slump Alberta is still feeling shows two things clearly: 1) Alberta remains heavily dependent on the oil and gas industry, perhaps more so than ever before, which shows that the government's talk of diversifying was either unsuccessful or simply talk; 2) the need to diversify Alberta's economy is stronger than ever. Alberta had great opportunities to diversity her economy, more than any other province had. Whether Alberta has the strength to diversify its

economy now is questionable. Grant Notley's response to the Lougheed government's effectiveness in diversifying Alberta's economy is brief: "It has been the lost decade . . . This government traded short-term boom for long-term strength, it is the master of short-term policies." 36 Critics argue that the Tory Government has merely toyed with economic diversification for more than a decade, leaving the province in its present predicament.

In 1981-82, the Department of Economic Development spent $20.9 million, a figure which includes the departmental personnel's wages and salaries. In 1982, the Alberta Opportunity Company (AOC) authorized approximately $41 million in loans to small business. The province has modestly financed industrial diversification. It has been through the use of crown corporations and joint venture companies that the province has pushed its industrial policy; examples include NOVA, Pacific Western Airlines, and the Alberta Energy Company. The government has not extensively used the Alberta Heritage Savings and Trust Fund to finance its strategy of economic diversification, preferring to maintain the fund as an investment reserve for future generations. However, some members argue that the Heritage Fund should be used to make investments in the high-tech field (Stan Nelson and Eric Musgreave have argued this case). On October 18, 1983, the Trust Fund committeerejected two of Eric Musgreave's proposals: 1) to set up a $100 million science and technology research foundation; 2) to set up a 'technology bridging foundation' to help transfer new scientific developments to the market place. Tory backbenchers have called for stronger efforts to diversity the economy, and indeed, this seems to echo frequent criticism that the Lougheed government is not doing all it can to diversify the province's industrial base. The fund itself may dwindle, since the reduction in royalty payments into the fund from 30 per cent to 15 per cent to enable the government to finance an incentive scheme for the oil and gas industry.

The Alberta Research Council is involved in a five year R & D strategy to harness public and private technological resources to develop Alberta's key economic sectors. The strategy focusses on energy resources, although it includes research programs such as the use of biotechnology to develop crops suitable for Alberta's short growing season, and the development of telecommunications.

It was the formation of a cabinet committe on research and science policy which led to the publication the the government's discussion paper tabled in this year's Spring Session of the Legislature. The policy draft paper is long overdue, and it is not clear whether or not it is already outdated. Yet, Alberta surely did not have to wait until 1984 for such a strategy. Alberta hung too dearly to its commitment to the resource industry, enjoying the benefits of high world energy prices and demand. Now that the prices of our oil and gas have fallen and the demand has slumped, Alberta's economic future is dim. Is Alberta yet able to encourage high-tech industries? An Edmonton Journal editorial (December 12, 1983) stated that

> . . . Alberta remains an adolescent economy, still over-reliant on basic resource production, albeit valuable resource production. It would be easier to accept this fact if the Lougheed government had been more ambitious in its efforts to diversify the economy in innovative ways.

The draft policy paper certainly does not offer any bold initiatives. The paper proposes the creation of a 17 member Alberta Technology Development Authority. The board members would be appointed by the government and re-appointment would be at government discretion. There are no measures or assurances that the board members would be non-partisan. The Technology Development Authority Board would create an Alberta Innovation Centre which would be incorporated with the Alberta Research Council. The Innovation Centre would offer

assistance to inventors, to Alberta companies who are developing high technology products and services, and would try to attract out of province high-tech companies, to name a few of its responsibilities. The paper distinguishes the major possibilities for a viable economic future for Alberta as:

> 1)Development of heavy fossil fuels as sources of energy and high value chemical products;
> 2)Expansion and diversification of Alberta's agricultural and forestry base; and
> 3)Diversification of manufacturing activity, especially into areas of the new technologies. 37

The paper contends that the government's role is to "create a high technology environment, to provide needed stimuli and to fill thegaps in the system so that the private sector can create, develop and expand in a range of new economic activities." In essence, the government is saying what it has always said . . . that it merely acts as a catalyst. Indeed, if one examines the government's past record of involvement in the private sector, one finds that despite its free-enterprise philosophy, the Tory Government has been interventionist in its approach to such an extent that rifts were created within the Progressive Conservative Party over certain government actions.

The government's policy paper is really more of what has happened in the past, written in the form of very vague motherhood statements. None of the proposals are very imaginative; certainly, there is none of the boldness which is required to inspire growth and development in Alberta. Moreover, the mechanisms which the paper does propose offer no assurances of accountability . . . again, more of the same.

Joya Sen is an industrial professor at the University of Alberta. He has stated that

> Development means a balanced economy, so that we have a strong industrial base with expanded manufacturing capacity. This is what creates jobs

> From this definition Alberta's economy would not even qualify as developed because manufacturing is so low. 38

Alberta is unprepared, it appears, to put forth the capital outlay which high technology demands. Economic Development Minister Hugh Planche is quoted in the March 10, 1984 edition of the Calgary Herald as stating: "The strategy will involve science and technology but the main thrust is to concentrate on what we do well here . . . We must maximize the extraction of hydrocarbons and continue to upgrade agriculture." As a final note to my review of the draft policy paper, it is best to remember that we are not even sure whether the paper has the sanction of Lougheed and his government, or whether it simply reflects the eagerness of officials in Economic Development. In the mean time, the government's slowness is fostering criticism such as the following remark made by the Edmonton Journal's Pete Brewster: "This government seems paralyzed by being so long in power that it is incapable of making decisions any more." 39

Examples offerred by other nations and provinces show that government action is needed in providing the framework for an industrial strategy. The key is to widen the decision-making process to include all the parties who are involved in the change. There is also the need to merge the accountability of business with the long-term framework developed by government. Government must address all the issues surrounding the transition to an economy based on high technology. There is a need to examine closely whether elaborate technology strategies developed and implemented elsewhere have worked. One must also question the reliance on policy-makers and planners in the formation of such policies. Private interests and the interests of Canadians, and Albertans, are not necessarily the same. The issues surrounding technology policy demand much deeper consideration. For example, we must question the cost

of emphasizing the applied sciences at the expense of the social sciences and pure science. To use economic development as the main objective of education is, in my mind, poor rationale. If we are intent on pursuing high-tech, we must confront issues such as unemployment. A confidential federal government study predicted that up to two million jobs will be non-existent by 1991; those people hit hardest will be women, natives, and young people. The Alberta government's draft policy paper does not address issues such as these to the extent that they deserve to be considered.

It appears that the provinces are the key actors in the drive towards encouraging high technology growth. This can be viewed either as an opportunity or as a liability. Intergovernmental collaboration is crucial, enabling provinces to tailor policies which meet their regions' special needs while providing strength and support through cooperative effort. It is going to take an unprecedented degree of imagination, boldness, and cooperation to ensure that the following prediction offerred by Frank Ogden does not become reality:

> Canada is now 17th among industrialized nations. I'm predicting that Canada will drop to at least 26th position. 40

FOOTNOTES

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